Front-end alignment and tolerance

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Introduction

- IDS-NF Front-end lattices:
  - G4BL/ICOOL lattices - IDR baseline - slightly different ICOOL/G4BL versions (cf. Anton's * website) → using G4BL version
  - G4BL lattice (Chris) based on the IDR with chicane in
  - G4BL/ICOOL lattices (Diktys) based on the IDR with Be windows + other changes (due to engineering constraints) but no chicane in
- Magnet geometry with NO REAL/PHYSICAL MAGNETS ☹:
  - we have fieldmaps for capture – matcher- cooler → how to change the field without redefining the whole set of current sheet that were used ? How to associate the field misalignment with real magnets misalignment ?
  - for drift-buncher-rotator a Bz=1.5 T (fieldexpr command) volume is defined
- RF cavities and windows + absorbers geometry:
  - real volumes are defined (but may miss some Be windows + Be windows in the buncher are of LiH)
  - cavities are ordered by cell (e.g. 13 cells of 1-2 or 3 cavities each for the buncher – each different in length)

* http://muonstoragerings.web.cern.ch/muonstoragerings/Students/aakimov/

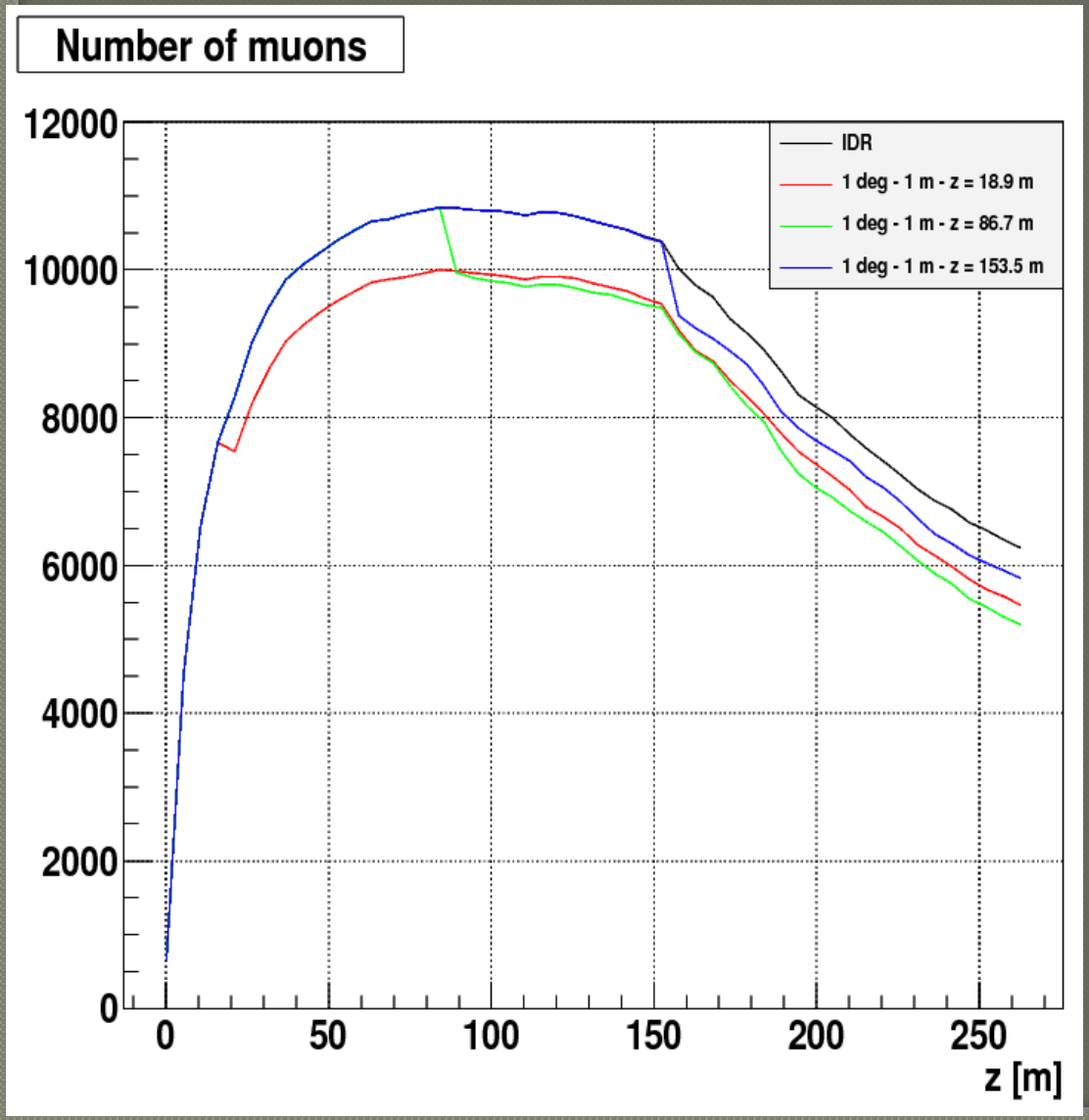
Magnetic field misalignment

- Changed the magnetic field direction in the drift-buncher-rotator:
  - solenoid symmetry can choose Bx = 0, By= 1.5 x sin ϕ Bz = 1.5 x cos ϕ
  - misalignment in a volume of 1 m length in z (IDR coils spec. are 0.5 m length with 0.25 m space between coils)
  - choosing different locations in z where to place the misaligned field
  - ϕ = 1 ° (approx. 2 cm vertical tilt for a 1m-long magnet)

Do we have somewhere more realistic coils engineering (length, space between coils) spec. for the drift-buncher-rotator ?

Do we want to set some tolerance such as number of muons within ecalc9f acceptance decreased by x% still acceptable ?

Total number of muons



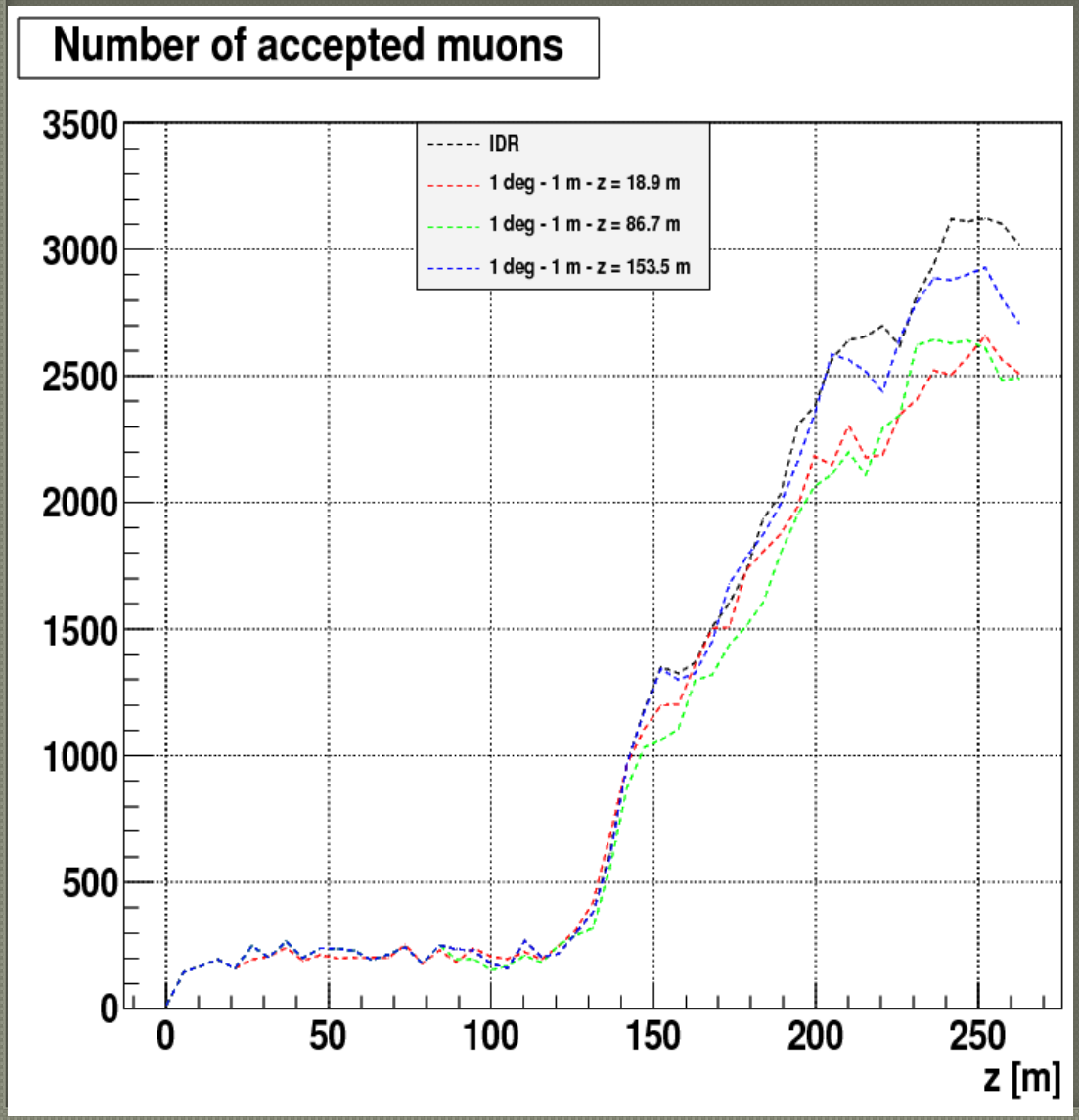
- Total number of muons:

~12% lower (end of taper)

~17% lower (middle of the drift)

~7% lower (end of the drift)

Muons within acceptance



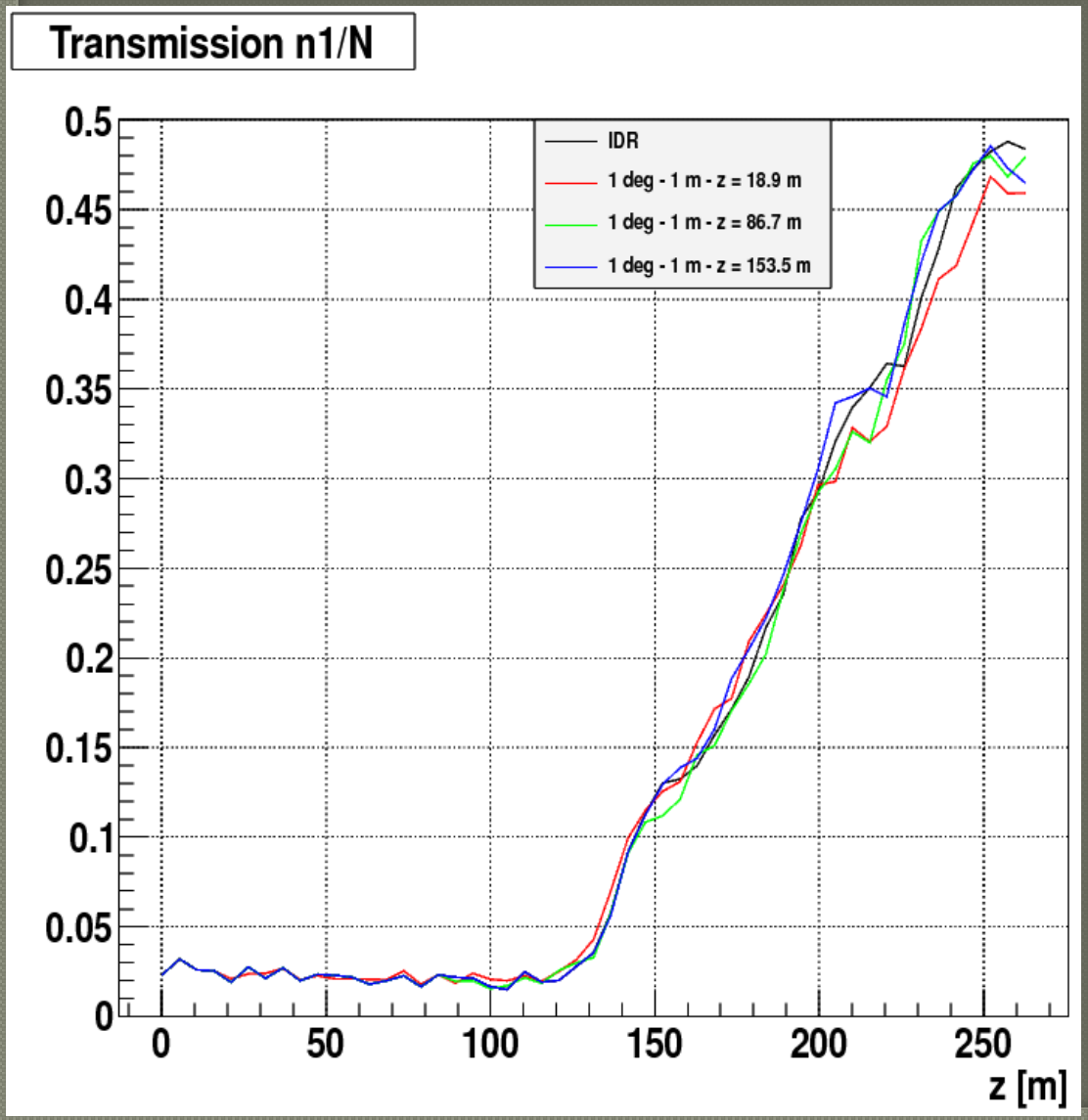
- Accepted muons:

~17% lower (end of taper)

~17% lower (middle of the drift)

~10% lower (end of drift)

Transmission



- Transmission:

~5% lower (end of taper)

~1% lower (middle of the drift)

~1% lower (end of drift)

Conclusion & todo

- If tolerance limit is less than a 15% decrease in number of muons/muons captured then a 1° 1 m-long magnet tilt in the drift – buncher-rotator is the absolute limit.
- Misalignment of the magnetic field in the beginning or middle of the drift is worse than at the end:
  - however not sure how G4BL handles transitions between fieldexpr and fieldmaps (does it add up components of field before and after the transition plane ?) → numbers can change depending on the accuracy for the field computation
- Need to:
  - find a way to misalign magnets in regions for which we have a field map
  - work on the RF- electric field misalignment
  - Interpret the misalignement in term of real magnets (need more detailed design)
  - redo simulations with the "final" (Diktys+chicane) lattice when ready